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SYSTEMATIC STATUS OF HUNGARIAN BULLHEAD POUT: ICTALURUS NEBULOSUS PANNONICUS ssp. n.

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Abstract

Morphological studies have been carried out by the authors on 337 specimens of bullhead pout *(Ictalurus nebulosus)* caught in Hungarian waters, and the results were compared with the data available from the literature. Taking into consideration the differences observed in the number of anal rays and in the pectorial spine, it is justified to distinguish the population of bullhead pout in Hungary and bordering regions showing the same characteristics as a separate subspecies under the name *Ictalurus nebulosus pannonicus* (ssp. n.). The formation of the new species can be attributed to the introgressive hybridization during the introduction of the species in Europe, as well as to the adaptation to the new, differrent environmental conditions.

Introduction

The acclimatization of the North-American ictalurid bullhead pout in Europe has begun at the end of the last century. The first European introduction took place in 1871 in France (VIVIER 1951). According to american data (KENDALL 1910) the regular delivery started with the first shipment to Belgium in 1884. The occurrence of this species in Germany has been observed since 1885 (SCHINDLER 1953). Its further spreading in Europe occurred on the one hand from Germany, and on the other — from further american import shipments. The provenance of the imported fish were the swamps in the Mississippi river valley, where collections have been carried out following the withdrawals of the floods. The majority of the imported bullhead pout has been identified as *Ictalurus nebulosus,* however, *I. punctatus* has been introduced as well, and, probably, *I. natalis* was present in the shipments, too (WHEELER 1978).

For a long time the bullhead pout, which became widespread in Europe has been referred to in the literature uniformly as Amiurus *(Ameiurus nebulosus),* and later as *Ictalurus nebulosus* (BERG 1949, BĂNĂRESCU 1964, LADIGES and VOGT 1965, BERINKEY 1966). For the first time the occurrence of *I. melas* species in Europe was reported by REDECKE (1941, cited in WHEELER 1978) in Holland.

In the 60s SPILLMANN (1967), TORTONESE (1967) and BĂNĂRESCU (1968) reached the conclusion that the populations found in France, Italy and Roumania belonged not to *I. nebulosus* but to *I. melas* species. Several authors attributed the earlier *I. nebulosus* data to misidentification and stated that the genus was represented in

Europe solely by *I. melas* (BĂNĂRESCU 1968, HUET 1970, BLANC et *al.* 1971). Contrary to these findings the results obtained by HOLČIK (1972) confirmed the earlier identification *(I. nebulosus)* in the population in Czechoslovakia, however, the author emphasized that the number of anal rays observed overlaps the numbers reported for these two species. After reviewing the data on bullhead pout, WHEELER (1978) contravened the findings of HUET (1970) and BLANC et *al.* (1971) concerning the exclusive occurrence of *I. melas* in Europe and accepted the occurrence of both *I. melas* and *I. nebulosus* on the continent. At the same time the author found that in Great Britain *I. melas* is the more often imported species, which he brings into connection with the fact that the provenance of bullhead pout imported for aquarium keeping or as experimental animals is usually Italy.

Among the publications dealing with this problem, particular attention is to be paid to the work of RAUNICH et. *al.* (1966), according to which the electrophoretic study of hemoglobin in the population found in the vicinity of Ferrara indicates mixing of characteristic traits of 3 species *(I. melas, I. natalis* and *I. nebulosus)*. However, the above paper does not deal with the morphological characteristics of the fish. SCOTT and CROSSMAN (1973) pointed at the occurrence of hybridization of *I. melas* and *I. nebulosus* species in natural conditions.

In the first place the results described above called for the investigation of the systematic status of bullhead pout found in Hungary. The study was justified as well by the fact that in 1980 *I. melas* has been imported to Hungary from a fish farm in the vicinity of Modena (Italy), and in the near future the appearance of its progeny is to be expected in a number of water basins.

Materials and Methods

The identification of Hungarian bullhead pout was based on live specimens caught in the Tisza river and the Hortobágy fishpond in 1983—87 ($n=200+100$ individuals), as well as on the conserved specimens in the collection of the Museum of Natural Sciences in Budapest ($n=54$ individuals). The latter originated mainly from the Danube ($n=30$ individuals) and other water basins in Hungary (for details on provenance see BERINKEY 1972).

In the work on identification the following studies have been used JORDAN and EVERMAN (1986), TRAUTMAN (1957), BLAIR et *al.* (1957), HUBBS and LAGLER (1958), SCHMITH-VANIZ (1968), SCOTT and CROSSMAN (1973), MOYLE (1976), LEE et *al.* (1980) and EDDY (1969).

For comparison we had at our disposal 10 live *I. melas* specimens belonging to the F_1 generation of the population imported in 1980 from Italy. The provenance of these specimens was Pér fishfarm (Western Hungary).

Results

As expected the question of identification has been eventually restricted to two species: *I. nebulosus* and *I. melas*. In the solution of the problem the following characteristic features have been taken into consideration:

1. The hind side of the pectoral spine in all specimens ($n=354$) without exception was markedly indented.

2. The flank colouring in every live specimen ($n=300$) was to a greater or lesser extent clouded and spotted. In the conserved specimens similar observations were made, however, those can not be considered authentical as far as the colouring is concerned.

3. The light-coloured transversal strip characteristic for *I. melas* was missing from the tail-fin base of the specimens ($n=300$). Although a lighter line was visible

in three palecoloured young specimens, it was significantly weaker and narrower than in the control *I. melas* individuals.

4. The colour of the fin-membranes was more or less identical with the colouring of the body and the rays ($n=300$), the smoky, blackish colouring characteristic for *I. melas* specimens have not been detected in any of the studied individuals.

Thus our results support earlier findings that Hungarian bullhead pout belongs to *I. nebulosus* species (LOVASSY 1927, VÁSÁRHELYI 1961, BERINKEY 1966, HARKA 1974, PINTÉR 1976).

The number of anal rays in *I. melas* and *I. nebulosus* was considered by JORDAN and EVERMANN (1896) to be an important distinguishing character as well. However, it has been shown in later studies that there is an overlapping in the number of anal rays reported for these two species (Fig. 1), and thus the ray number can not be considered as a species distinguishing character.

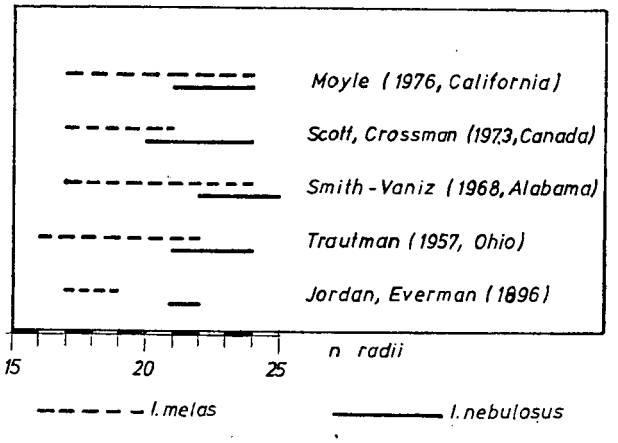

Fig. 1. Number of anal rays of *I. melas* and *I. nebulosus* according to different authors

In the Hungarian *I. nebulosus* specimens studied ($n=337$, since some of the conserved specimens were not suitable for investigation) the number of anal rays was as follows:

Number of rays	17	18	19	20	21	22	23
Number of specimens	5	19	86	131	81	13	2
Mean value:	19,92						

Discussion

Our findings are in agreement with the data obtained in the regions bordering on Hungary. In a study of 43 specimens originating from Czechoslovakia HOLČIK 1972) extreme values of 17 and 23, and a mean value of 20,09 were registered, the results obtained by MALETIN (1982) in Jugoslavia on 270 specimens were as follows: extreme values 18 and 22, mean value 19,27.

Similar results were obtained in Roumania as well, where the number of anal rays was 19—22 (BĂNĂRESCU 1964) and 17—20 (BĂNĂRESCU 1968). In the latter

work the author taking into consideration among others the number of anal rays assigned the Roumanian population to *I. melas* species, however, HOLČIK (1972) suggested a revision of this classification, based on the studies carried out on specimens from the Timis river (Roumania). The markedly indented pectoral spine of the Roumanian bullhead pout specimens found in the collection of the Museum of Natural Sciences in Budapest ($n=62$) justify the reassignment. The number of anal rays in this group varied between 17 and 23, mean value 19,15.

Comparison of the East-Middle-European and North-American data shows that the minimal number of anal rays detected in the European *I. nebulosus* populations was significantly lower, and the mean values as well did not reach the minimal numbers observed in America (Fig. 2).

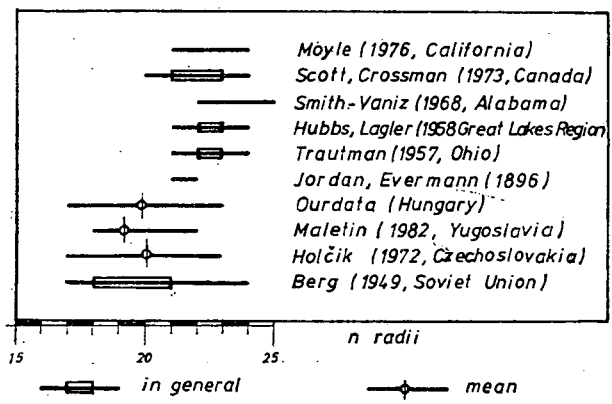

Fig. 2. Number of anal rays of *I. nebulosus* populations in Europe and North-America according to different authors

According to HOLČIK (1972) the differences observed are due possibly to adaptation, however, the possibility of hybridization should not be neglected either, since among the specimens imported to Europe besides *I. nebulosus* the occurrence of the closely related *I. melas* is highly probable, and since initially the fish were kept in artificial conditions.

The number of anal rays in the Eastern-Middle-European *I. nebulosus* (17—24) and *I. melas* (16—24) populations is nearly identical, which can be considered to result from hybridization of these two species, in the course of which some traits characteristic for *I. melas* were transferred to *I. nebulosus* (and vice versa), and since during their spreading in Europe the specimens did not encounter a pure population, the acquired properties became stabilized.

Another stabilized characteristic feature of the Hungarian bullhead pout is that the front side of the pectoral spine is not completely smooth but finely barbed, rough or occasionally indented (Fig. 3). These features resemble the characteristics of *I. natalis,* thus in our case the possibility of triple hybridization suggested by RAUNICH et *al.* (1966) can be considered as well. The roughness of the front side of pectoral spine is clearly visible in the figure based on the studies of HOLČIK (1972) in Czechoslovakia.

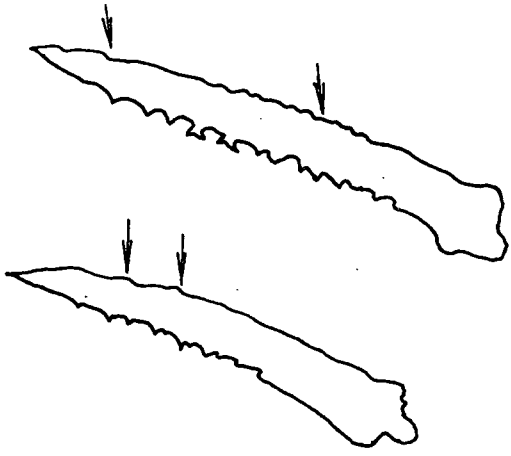

Fig. 3. Ruggedness of the pectoral spine of *Ictalurus nebulosus pannonicus ssp. n.*
Above: original pectoral spine (length 23,5 mm) of an individual caught in the Tisza river at Tiszafüred.
Below: Pectoral spine (length 21,1 mm) of an individual caught in the Danube at Sturovo (after HOLČIK, 1972)

Taking into consideration the differences in the number of anal rays and in pectoral spine, as well as the separate spreading region, it is justified to distinguish the population in Hungary and bordering regions as a separate species under the name of *I. nebulosus pannonicus* (ssp. n.).

Ictalurus nebulorus pannonicus (ssp. n.)

Holotype: female, standard length 213 mm. Deposited in the fish collection of the Museum of Natural Sciences in Budapest (No. 87. 1. 1.). Collected by Á. HARKA in the Tisza river at Poroszló, on April 14, 1987. Characteristic features — Table 1.

Table 1. *Characteristics of the holotype and paratypes of Ictalurus nebulosus pannonicus ssp. n.*

Trait	Holotype	Paratype	
		extreme values	mean value
Standard length	213	132—148	139,2
Full length	250	158—178	167,6
Body max. length	46	27—35	30,9
Tail shaft min. height	25	15—19	16,6
Predorsal distance	76	49—60	52,4
Head length	61	38—44	40,6
Interorbital distance	30	17—25	20,5
Eye diameter	8	4—5	4,6
Preorbital distance	21	11—15	13,1
Length of the anal fin	48	30—34	32,8
Hight of the anal fin	31	16—21	18,7
Number of anal rays	20	19—21	20,1

The measures are given in mm

Paratypes: 13 specimens, standard length varying between 132 and 148 mm. Deposited in the same collection as the holotype (No. 87.2.1.). Collected by Á. HARKA in the Tisza river at Poroszló on June 24, 1987. Characteristic features — summarized in Table 1.

Other materials (deposited in the same collection): No. 87.3.1. 6 bone preparations of *Ictalurus n. pannonicus* (skull+spine+the first ray of the pectoral and dorsal fin), Tisza (Tiszafüred), November 14, 1986 (l. Á. HARKA). No. 87.4.1. 10 bone preparations of *Ictalurus n. pannonicus* (see the item above), Tisza (Poroszló), November 20, 1986 (l. Á. HARKA). No. 87.5.1. 9 bone preparations of *Ictalurus n. pannonicus* (see the items above), Tisza (Poroszló), April 14, 1987 (l. Á. HARKA).

Description. Pinna dorsalis: 1/5—6; p. analis: 3—4/14-19; p. pectoralis: 1/7—8; p. ventralis: 1/7; p. caudalis: 16—19+a number of rudiments. The number of vertebra, without Weberbones 37—39, the mean value based on 27 specimens 37,6. The side line in the fore and middle part of the body is continuous, at the tail shaft often broken or incomplete, and can differ at the two flanks. The main morphometric characteristics essentially agree with the values given by SCOTT and CROSSMAN (1973) for *I. nebulosus* species (Table 2).

Table 2. *Morphometric characteristics of I. nebulosus (a) and I. n. pannonicus (b, c)*

	a	b	c
Expressed as percentage of the full length:			
Head length	22,6—26,3	21,2—26,5	23,8
Max. body hight	17,7—26,3	17,0—22,3	18,8
Tail shaft min. hight	8,1—9,9	8,6—10,6	9,8
Predorsal distance	30,4—34,3	27,6—33,2	31,3
Base of the anal fin	17,5—20,7	17,6—22,2	19,8
Expressed as percentage of the head length:			
Preorbital length	35,6—44,2	31,0—41,8	35,6
Interorbital length	45,2—53,2	45,2—63,6	52,6
Eye diameter	10,0—18,7	6,9—14,1	10,7

a: After Scott and Crossman (1973)
b and c: extreme values and mean value (based on 50 individuals)

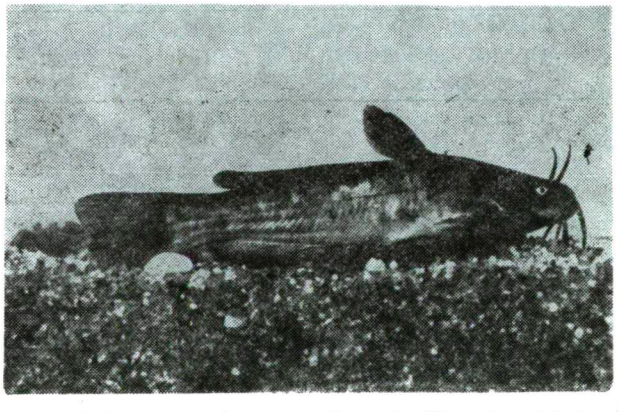

Fig. 4. *Ictalurus nebulosus pannonicus* ssp. n. from the Tisza river (photo: Á. HARKA)

Colouring. The dorsal colouring varies from yellowish-brown to blackish-brown, the flanks are of paler colour, to a greater or lesser extent cloudy, the abdomen is off-white or yellowish white. The colouring of the fins is similar to that of the body, their distal parts being often less pigmented (Fig. 4).

Ecology. The subspecies does not impose particular requirements, favours in the first place shallow waters with rich vegetation but can be found in the rivers as well.

Terra typica: Storage-lake of the Tisza river, Eastern Hungary.

Geographical distribution: At present known to occur in the Carpatian basin in the river systems of the Danube and Tisza, but according to the data of Frank (cited in HOLČIK, 1972) on the Elba region, a wider spreading could be possible, too.

Etymology. The name pannonicus refers to the presently known spreading region of the subspecies — Carpathian or Pannonian basin.

Formation. The formation of the new subspecies in the course of the species introduction in Europe is possibly due to environmental adaptation and the introgression of the various *Ictalurus*-species *(I. nebulosus, I. melas, I. natalis)*.

Distinction of *Ictalurus nebulosus* subspecies.

The distinction of the *I. nebulosus* subspecies can be based on the following key:

1. The front side of the pectoral spine is smooth, the number of anal rays is generally 22—24.
   1/a The flanks are faintly spotty, cloudy. Occurrence: South-Canada; USA
   I. n. nebulosus (LESUEUR, 1819)
   1/b The flanks are markedly spotty, cloudy. Occurrence: USA, from Indiana to Florida
   I. n. marmoratus (HOLBROOK 1855)
2. The front side of the pectoral spine is uneven, finely barbed, rough or rugged, the number of anal rays is generally 18—21. Occurrence: Eastern-Middle-Europe.
   I. n. pannonicus ssp. n.

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Magyarország törpeharcsáinak rendszertani helye: Ictalurus nebulosus pannonicus ssp. n.

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Kivonat

A szerzők 337 db, magyarországi vizekből származó törpeharcsa *(Ictalurus nebulosus)* morfológiai vizsgálatát végezték el és eredményeiket összevetették a rendelkezésre álló irodalmi anyaggal. A farokalatti úszó sugarainak (anal rays) száma és a mellúszó tüske (pectoral spine) eltérései alapján indokolt a magyarországi valamint a környező területek hasonló jellegzetességekkel bíró törpeharcsa populációinak önálló alfaji megkülönböztetése *Ictalurus nebulosus pannonicus* (ssp. n.) néven. Az új alfaj kialakulása az európai betelepítéskor bekövetkezett introgresszív hibridizációval valamint az új, eltérő környezeti viszonyokhoz való adaptációval magyarázható.

СИСТЕМАТИЧЕСКАЯ КЛАССИФИКАЦИЯ ВЕНГЕРСКОГО СОМА: ICTALURUS NEBULOSUS PANNONICUS ssp. n.

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Авторами проведены морфологические исследования 337 особей *Ictalurus nebulosus*, пойманных в венгерских водах, и результаты сравнены с литературными данными. Принимая во внимание различия, наблюдаемые в числе лучей анального плавника и в пекторальной ости, обосновано обособление популяции сома, распространенной в Венгрии и примыкающих областях, в отдельный подвид под названием *Ictalurus nebulosus pannonicus* (ssp. n). Возникновение новой популяции может быть объяснено интрогрессивной гибридизацией во время введения этого вида в Европе, а также адаптацией к условиям новой окружающей среды.

Mesto patuljastih somića (Ictalurus nebulosus pannonicus ssp. n.) u zootaksonomiji nađene u Mađarskoj

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Rezime

Autori su izvršili morfološku analizu 337 primeraka patuljastih somića *(Ictalurus nebulosus)* poticane iz mađarskih voda, dobiveni rezultati su bili upoređeni sa literaturnim podacima. Na temelju broj zraka analnog peraja (anal rays) i diferencijama bodljama prsnog peraja (pectoral spine) potrebno je odvajati podvrste patuljastog somića nađene u mađarskim i u okolnim regijama na imenu *Ictalurus nebulosus pannonicus* ssp. n. Razvoj novog podvrsta može se objasniti introgresivnom hibridizacijom, koji se dogodilo poslije nasele u Evropu i sa adaptacijom prema novim ekološkim okolnostima.